

# Glossary

**Action** - A force (push or pull) acting on an object. See Reaction.

**Active Controls** - Devices on a rocket that move to control the rocket's direction in flight.

**Attitude Control Rockets** - Small rockets that are used as active controls to change the attitude (direction) a rocket or spacecraft is facing in outer space.

**Canards** - Small movable fins located towards the nose cone of a rocket.

**Case** - The body of a solid propellant rocket that holds the propellant.

**Center of Mass (CM)** - The point in an object about which the object's mass is centered.

**Center of Pressure (CP)** - The point in an object about which the object's surface area is centered.

**Chamber** - A cavity inside a rocket where propellants burn.

**Combustion Chamber** - See Chamber.

**Drag** - Friction forces in the atmosphere that "drag" on a rocket to slow its flight.

**Escape Velocity** - The velocity an object must reach to escape the pull of Earth's gravity.

**Extravehicular Activity (EVA)** - Spacewalking.

**Fins** - Arrow-like wings at the lower end of a rocket that stabilize the rocket in flight.

**Fuel** - The chemical that combines with an oxidizer to burn and produce thrust.

**Gimbaled Nozzles** - Tiltable rocket nozzles used for active controls.

**Igniter** - A device that ignites a rocket's engine(s).

**Injectors** - Showerhead-like devices that spray fuel and oxidizer into the combustion chamber of a liquid propellant rocket.

**Insulation** - A coating that protects the case and nozzle of a rocket from intense heat.

**Liquid Propellant** - Rocket propellants in liquid form.

**Mass** - The amount of matter contained within an object.

**Mass Fraction (MF)** - The mass of propellants in a rocket divided by the rocket's total mass.

**Microgravity** - An environment that imparts to an object a net acceleration that is small compared with that produced by Earth at its surface.

**Motion** - Movement of an object in relation to its surroundings.

**Movable Fins** - Rocket fins that can move to stabilize a rocket's flight.

**Nose Cone** - The cone-shaped front end of a rocket.

**Nozzle** - A bell-shaped opening at the lower end of a rocket through which a stream of hot gases is directed.

**Oxidizer** - A chemical containing oxygen compounds that permits rocket fuel to burn both in the atmosphere and in the vacuum of space.

**Passive Controls** - Stationary devices, such as fixed rocket fins, that stabilize a rocket in flight.

**Payload** - The cargo (scientific instruments, satellites, spacecraft, etc.) carried by a rocket.

**Propellant** - A mixture of fuel and oxidizer that burns to produce rocket thrust.

**Pumps** - Machinery that moves liquid fuel and oxidizer to the combustion chamber of a rocket.

**Reaction** - A movement in the opposite direction from the imposition of an action. See Action.

**Rest** - The absence of movement of an object in relation to its surroundings.

**Regenerative Cooling** - Using the low temperature of a liquid fuel to cool a rocket nozzle.

**Solid Propellant** - Rocket fuel and oxidizer in solid form.

**Stages** - Two or more rockets stacked on top of each other in order to reach higher altitudes or have a greater payload capacity.

**Throat** - The narrow opening of a rocket nozzle.

**Unbalanced Force** - A force that is not countered by another force in the opposite direction.

**Vernier Rockets** - Small rockets that use their thrust to help direct a larger rocket in flight.



# NASA Educational Materials

NASA publishes a variety of educational resources suitable for classroom use. The following resources, specifically relating to the topic of rocketry, are available from the NASA Teacher Resource Center Network. Refer to the next pages for details on how to obtain these materials.

## Liftoff to Learning Educational Video Series That Relate to Rockets

### ***Space Basics***

Length: 20:55

Recommended Level: Middle School

Application: History, Physical Science

*Space Basics* explains space flight concepts such as how we get into orbit and why we float when orbiting Earth. Includes a video resource guide.

### ***Newton in Space***

Length: 12:37

Recommended Level: Middle School

Application: Physical Science

*Newton in Space* demonstrates the difference between weight and mass and illustrates Isaac Newton's three laws of motion in the microgravity environment of Earth Orbit. Includes a video resource guide.

## Other Videos

Videotapes are available about Mercury, Gemini, Apollo, and Space Shuttle projects and missions. Contact the Teacher Resource Center that serves your region for a list of available titles, or contact CORE (See page 109.).

## Publications

- McAleer, N. (1988), *Space Shuttle - The Renewed Promise*, National Aeronautics and Space Administration, PAM-521, Washington, DC.
- NASA (1991), *Countdown! NASA Launch Vehicles and Facilities*, Information Summaries, National Aeronautics and Space Administration, PMS-018-B, Kennedy Space Center, FL.
- NASA (1991), *A Decade On Board America's Space Shuttle*, National Aeronautics and Space Administration, NP-150, Washington, DC.
- NASA (1987), *The Early Years: Mercury to Apollo-Soyuz*, Information Summaries, National Aeronautics and Space Administration, PMS-001-A, Kennedy Space Center, FL.
- NASA (1991), *Space Flight, The First 30 Years*, National Aeronautics and Space Administration, NP-142, Washington, DC.
- NASA (1992), *Space Shuttle Mission Summary, The First Decade: 1981-1990*,

Information Summaries, National Aeronautics and Space Administration, PMS-038, Kennedy Space Center, FL.

- Roland, A. (1985), *A Spacefaring People: Perspectives on Early Spaceflight*, NASA Scientific and Technical Information Branch, NASA SP-4405, Washington, DC.

## Lithographs

- HqL-367 Space Shuttle *Columbia* Returns from Space.
- HqL-368 Space Shuttle *Columbia* Lifts Off Into Space.

## Suggested Reading

These books can be used by children and adults to learn more about rockets. Older books on the list provide valuable historical information rockets and information about rockets in science fiction. Newer books provide up-to-date information about rockets currently in use or being planned.

- Asimov, I. (1988), *Rockets, Probes, and Satellites*, Gareth Stevens, Milwaukee.
- Barrett, N. (1990), *The Picture World of Rockets and Satellites*, Franklin Watts Inc., New York.
- Bolognese, D. (1982), *Drawing Spaceships and Other Spacecraft*, Franklin Watts, Inc., New York.
- Branley, F. (1987), *Rockets and Satellites*, Thomas Y. Crowell, New York.
- Butterfield, M. (1994), *Look Inside Cross-Sections Space*, Dorling Kindersley, London.
- Donnelly, J. (1989), *Moonwalk, The First Trip to the Moon*, Random House, New York.
- English, J. (1995), *Transportation, Automobiles to Zeppelins*, A Scholastic Kid's Encyclopedia, Scholastic Inc., New York.
- Fischel, E. & Ganeri, A. (1988), *How To Draw Spacecraft*, EDC Publishing, Tulsa, Oklahoma.
- Furniss, T. (1988), *Space Rocket*, Gloucester, New York.
- Gatland, K. (1976), *Rockets and Space Travel*, Silver Burdett, Morristown, New Jersey.
- Gatland, K. & Jeffris, D. (1977), *Star Travel: Transport and Technology Into The 21st Century*, Usborn Publishers, London.
- Gurney, G. & Gurney, C. (1975), *The Launch of Sputnik, October 4, 1957: The Space Age Begins*, Franklin Watts, Inc., New York.
- Malone, R. (1977), *Rocketship: An Incredible Voyage Through Science Fiction and Science Fact*, Harper & Row, New York.
- Maurer, R. (1995), *Rocket! How a Toy Launched the Space Age*, Crown Publishers, Inc., New York.
- Mullane, R. M. (1995), *Liftoff, An Astronaut's Dream*,



Silver Burdett Press, Parsippany, NJ.

Neal, V., Lewis, C., & Winter, F. (1995), Smithsonian Guides, Spaceflight, Macmillan, New York. (Adult level reference)

Parsons, A. (1992), What's Inside? Spacecraft, Dorling Kindersley, Inc., New York.

Ordway, F. & Leibermann, R. (1992), Blueprint For Space, Science Fiction To Science Fact, Smithsonian Institution Press, Washington DC.

Quackenbush, R. (1978), The Boy Who Dreamed of Rockets: How Robert Goddard Became The Father of the Space Age, Parents Magazine Press, New York.

Ride, S. & Okie, S. (1986), To Space & Back, Lee & Shepard Books, New York.

Shayler, D. (1994), Inside/Outside Space, Random House, New York.

Shorto, R. (1992), How To Fly The Space Shuttle, John Muir Publications, Santa Fe, NM.

Vogt, G. (1987), An Album of Modern Spaceships, Franklin Watts, Inc., New York.

Vogt, G. (1989), Space Ships, Franklin Watts, Inc., New York.

Winter, F. (1990), Rockets into Space, Harvard University Press, Cambridge, Massachusetts. (Adult level reference)

## Commercial Software

Physics of Model Rocketry

Flight: Aerodynamics of Model Rockets

In Search of Space - Introduction to Model Rocketry

The above programs are available for Apple II, Mac, and IBM from Estes Industries, 1295 H. Street, Penrose, Colorado 81240

## Electronic Resources

The following listing of Internet addresses will provide users with links to educational materials throughout the World Wide Web (WWW) related to rocketry.

### NASA Resources

NASA SpaceLink

<http://spacelink.nasa.gov>

NASA Home Page

<http://www.nasa.gov/>

Space Shuttle Information

<http://spaceflight.nasa.gov>

